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REPORT ON THE SIXTH UNITED NATIONS INTERNATIONAL TRAINING COURSE ON REMOTE SENSING EDUCATION FOR EDUCATORS

(Stockholm and Kiruna, Sweden, 6 May to 15 June 1996)

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INTRODUCTION

A. Background and objectives

1. The Sixth United Nations International Training Course on Remote Sensing Education for Educators, held at Stockholm and Kiruna, Sweden, from 6 May to 15 June 1996, was organized by the United Nations Programme on Space Application in cooperation with the Government of Sweden. The course was conducted specifically for the benefit of educators from developing countries with the objective of enabling them to introduce remote sensing courses in their respective academic institutions. It was co-sponsored by the Swedish International Development Agency (SIDA) on behalf of the Government of Sweden, and hosted by

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the Department of Physical Geography of Stockholm University and by the Swedish Space Corporation (SSC Satellitbild).

2. The present report describes the organization of the training course, its technical contents, the results of the course evaluation and the proposed follow-up actions. It has been prepared for the Committee on the Peaceful Uses of Outer Space and its Scientific and Technical Subcommittee.

B. Organization and programme

3. Application forms and information brochures on the training course were sent out in November 1995 by the Office for Outer Space Affairs of the United Nations to offices of the United Nations Development Programme for transmission to the relevant national authorities. The same material was distributed simultaneously by Stockholm University to the embassies of Sweden in 75 developing countries and to previous course participants for circulation in their academic institutions. Over 120 completed applications were subsequently received and jointly processed by the Office for Outer Space Affairs and Stockholm University. The selection of participants was completed by the end of February 1996, approximately two months before the start of the course.

4. Twenty-six candidates, including five women, were selected as participants. The participants came from the following 18 States and from Palestine: Bolivia, Chile, Ecuador, Eritrea, Ethiopia, Ghana, Jordan, Nigeria, Nepal, Pakistan, Senegal, Sierra Leone, Sri Lanka, Uganda, Venezuela, Viet Nam, Zambia and Zimbabwe. Funds for the international travel of 13 participants were provided from the fellowship budget of the United Nations Programme on Space Applications. All other support, including international travel of the remaining 13 participants, room and board, course materials, and inland transport for all 26 participants, was provided by the Government of Sweden.

5. Course instructors came from several institutions, including the Office for Outer Space Affairs, the European Space Agency (ESA), SIDA, Stockholm University, Uppsala University, the Swedish National Space Board, the Swedish Royal Institute of Technology, the Swedish Society for Nature Conservation and SSC Satellitbild.

I. SUMMARY OF THE CONTENTS OF THE COURSE

6. The technical contents of the course were determined by the Department of Physical Geography of Stockholm University, with input from the Office for Outer Space Affairs. The course was modular in format and consisted of a series of lectures and office and field exercises. A more detailed summary of the contents of the course can be found in document A/AC.105/617, the report on the fifth course in the series.

7. The first technical module of the course lasted 4 days and dealt with the fundamental principles of remote sensing. The principal topics covered were the following: electromagnetic radiation, the reflective properties of various types of materials on the surface of the Earth, and elementary optics; electronic imaging; georeferencing objects in the field, on maps and on satellite imagery; and Earth resources and environmental satellites.

8. Four days were subsequently devoted to image interpretation and presentations on the following subjects: remote sensing for land use planning and environmental monitoring; remote sensing for geological studies; introduction to visual interpretation and in-service training in developing countries.

9. To reinforce understanding of the principles of image interpretation, participants were divided into groups on a regional basis, each of which studied a case history where visual interpretation of satellite images played a key role. The case histories were: land and water development in Ethiopia; land use mapping in

the United Republic of Tanzania; forestry in Ecuador; geological applications in Central America; environmental impact assessment of the closure of a river arm in Bangladesh; and environmental impact assessment of hydropower development in the Lao People's Democratic Republic.

10. An additional series of lectures dealt with digital image analysis and geographic information systems (GIS). This series lasted 6 days and covered the following subjects: digital analysis (theory); computer image enhancement (theory); reception and handling of advanced very high resolution radiometer data; GIS theory; and digital image processing techniques, GIS applications, CD-ROM, data capture, compass techniques and global positioning systems.

11. The participants were also introduced, over a period of three days, to the principles of radar image formation and the use of such images in various development and research applications. In addition, they were introduced to the use of appropriate procedures for the field verification of interpretations of remotely sensed data using satellite images of the Skinnskatteberg area of southern Sweden.

12. The succeeding part of the course was held at Kiruna, at the facilities of SSC Satellitbild. Four days were reserved for visual interpretation exercises and presentation of results. Wherever possible, the exercises were carried out on images selected by the participants of regions of their countries with which they were familiar. Lectures were presented on the following subjects: archiving, catalogue updating and standard production of images; image processing, value-added production, radiometric and geometric corrections, and production of digital elevation models, digital terrain models and orthoimages; computerized cartography; standard and higher-level processed imagery; selection of remote sensing media and products; future Earth satellites.

13. During this part of the course, in which the needs of the user were being highlighted, the representative of the United Nations made a presentation entitled "Enhancing the use of space technology in developing countries: a review of the formal recommendations made at meetings organized by the Office for Outer Space Affairs". While at Kiruna, technical visits were arranged for the participants to a number of sites of interest, including the ESA/Salmijarvi and Esrange satellite receiving stations, and the Kirunavaara underground mine. Lectures were supplemented by tours of the production facilities of SSC Satellitbild.

14. The final part of the course concerned the development of remote sensing curricula, and was held over a period of two days at the Department of Physical Geography of Stockholm University. It was followed by a half-day meeting reserved for formal evaluation of the course. The participants spent approximately two hours discussing various aspects of the course and making recommendations in preparation for that meeting.

II. COURSE EVALUATION

15. The recommendations of participants were formally presented to representatives of the Office for Outer Space Affairs, SIDA and the Department of Geography of Stockholm University and to selected course lecturers. Discussions following the formal presentation by a representative of the participants allowed additional inputs to be made by all participants.

16. The recommendations made by the participants were aimed at improving the course to make it even more responsive to evolving needs in their countries and academic institutions. The main recommendations were as follows:

(a) The parts of the course dealing with visual image interpretation and remote sensing curricula should be shortened;

(b) The parts of the course dealing with digital image processing, GIS, radar, and cost-benefit analysis should be expanded;

(c) The availability of satellite images of their home countries requested by participants for use during the training course should be improved;

(d) The amount of free time allowed to participants to review some of the copious volume of technical material presented during lectures should be increased.

17. The participants noted that, at times, because of either excessive cloud cover in available images or the absence of archived satellite images of a specific region, some participants are obliged to work on images of areas with which they are unfamiliar, a situation which detracts from the didactic value of the course.

III. PROPOSED FOLLOW-UP ACTION

18. On the basis of the various recommendations outlined above, the Office for Outer Space Affairs proposes to undertake the following two actions. In collaboration with Stockholm University, the Office will make a final selection of participants early enough to ensure that information concerning the availability of images of their home countries is communicated to them well in advance of the course. The choice of study areas made by participants would then be based on a knowledge of the available images. The Office will also continue discussions with SIDA and Stockholm University on the feasibility of holding a more advanced course for remote sensing educators.